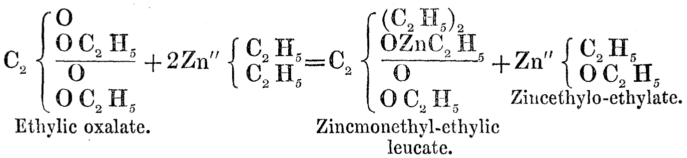
It was obviously impossible to collect in a state of purity the iodide of ethyl thus set at liberty without considerable loss; but the quantity of the pure iodide actually obtained was 12 grms. The above equation requires 14·6 grms.

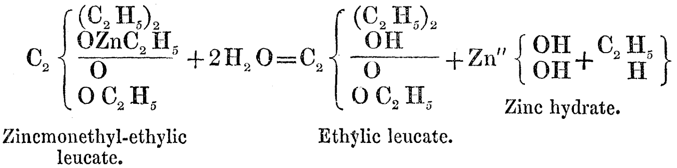
On the removal of ether and iodide of ethyl, the mixture of zincoleucic ether and iodide of zinc forms a transparent gummy mass easily soluble in ether, bisulphide of carbon, and caoutchoucin, but totally incapable of crystallizing from any of its solutions. All our attempts to separate these bodies have hitherto proved abortive, and it is by no means improbable that they are chemically combined.

The action of zincethyl upon ethylic leucate throws much light upon the production of the latter from zincethyl and ethylic oxalate, and scarcely leaves a doubt that, when zincethyl is added to ethylic leucate, there is reproduced the zinc compound from which the ethylic leucate was first formed. We may therefore express the two stages in the original production of ethylic leucate by the following equations:—



$$C_2\left\{\begin{array}{l}O\\ O\,C_2H_5\\ \hline O\\ O\,C_2H_5\end{array}\right. + 2Zn''\left\{\begin{array}{l}C_2H_5\\ C_2H_5\end{array}\right. = C_2\left\{\begin{array}{l}(C_2H_5)_2\\ OZnC_2H_5\\ \hline O\\ O\,C_2H_5\end{array}\right. + Zn''\left\{\begin{array}{l}C_2H_5\\ O\,C_2H_5\end{array}\right.$$

Ethylic oxalate. Zincmonethyl-ethylic leucate. Zincethylo-ethylate.



$$C_2\left\{\begin{array}{l}(C_2H_5)_2\\ OZnC_2H_5\\ \hline O\\ O\,C_2H_5\end{array}\right. + 2H_2O = C_2\left\{\begin{array}{l}(C_2H_5)_2\\ OH\\ \hline O\\ O\,C_2H_5\end{array}\right. + Zn''\left\{\begin{array}{l}OH\\ OH\end{array}\right. + \left.\begin{array}{l}C_2H_5\\ H\end{array}\right\}$$

Zincmonethyl-ethylic leucate. Ethylic leucate. Zinc hydrate.

III. "Notes of Researches on the Acids of the Lactic Series.—No. IV. Action of Zinc upon Oxalic Ether and the Iodides of Methyl and Ethyl mixed in atomic proportions." By E. Frankland, F.R.S. and B. F. Duppa, Esq. Received February 2, 1865.

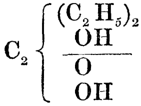
The reaction of zinc upon oxalic ether in the presence of iodide of amyl, the results of which we hope very shortly to have the honour of laying before the Royal Society, had led us to anticipate, that if an oxalate of one organic radical were treated with the iodide of another, one atom of diatomic oxygen in the oxalic ether would be replaced by two different monatomic radicals. This anticipation was not, however, realized, as we have already shown*, when the reaction was extended to a mixture of iodide of ethyl with oxalate of methyl, and iodide of methyl with oxalate of ethyl. In both these cases the radicals presented in the form of iodides were the

---

* Proceedings of the Royal Society, vol. xiv. p. 17.

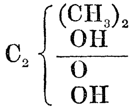
The Royal Society is collaborating with JSTOR to digitize, preserve, and extend access to *Proceedings of the Royal Society of London.* www.jstor.org

only ones entering into the composition of the resulting acids, which proved to have respectively the composition of leucic or diethoxalic acid,



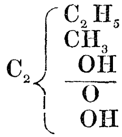
$$C_2\left\{\begin{array}{l}(C_2H_5)_2\\ OH\\ \hline O\\ OH\end{array}\right.$$

and dimethoxalic acid,



$$C_2\left\{\begin{array}{l}(CH_3)_2\\ OH\\ \hline O\\ OH\end{array}\right.$$

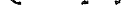
Certain theoretical considerations, however, rendered it important for us to be able distinctly to label each radical entering into the composition of the derived acids, so as to enable us with certainty to trace its source, and, if possible, to determine its position or value in the resulting complex molecule. We therefore endeavoured to accomplish the desired end by acting with zinc upon a mixture consisting of one atom of oxalic ether and one atom each of the iodides of methyl and ethyl, by which we hoped to obtain an acid of the following composition:—



$$C_2\left\{\begin{array}{l}C_2H_5\\ CH_3\\ OH\\ \hline O\\ OH\end{array}\right.$$

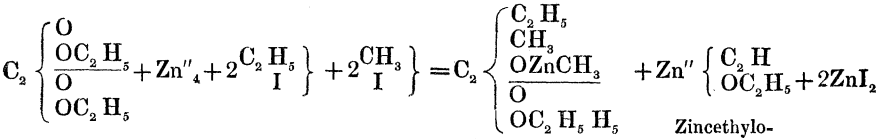
Experiment completely proved the practicability of this reaction, and its result even exceeded our expectations, since not only was the ether corresponding to the above acid formed with the greatest facility, but it was produced almost to the complete exclusion of the ethers of leucic and dimethoxalic acids.

200 grms. of oxalic ether were mixed with the proper atomic proportions of iodide of methyl and iodide of ethyl, and were digested with granulated zinc for several days at a temperature of from 35° to 40° C., until the supernatant liquid became oily, and solidified to a crystalline mass on cooling. Water being now added until effervescence ceased, the whole was submitted to distillation in an oil-bath. With the exception of a small quantity of the mixed iodides of ethyl and methyl that had escaped decomposition, the distillate consisted of a homogeneous liquid composed of water, ethylic and methylic alcohols, and an ethereal body, which last was separated by repeated agitation with large volumes of ether and subsequent rectification. In this manner there was obtained a large quantity of a liquid which boiled constantly at 165°·5 C., and yielded on analysis numbers very closely corresponding with the formula



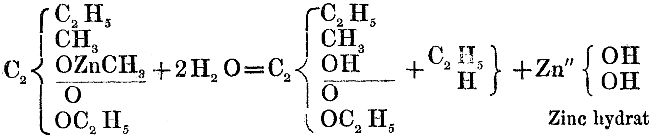
$$C_2\left\{\begin{array}{l}C_2H_5\\ CH_3\\ OH\\ \hline O\\ OC_2H_5\end{array}\right.$$

The production of this ether is explained in the following equations:—



$$C_2\left\{\begin{array}{l} O \\ \underline{OC_2H_5} \\ O \\ OC_2H_5 \end{array}\right. + Zn''_4 + 2\left.\begin{array}{c}C_2H_5\\ I\end{array}\right\} + 2\left.\begin{array}{c}CH_3\\ I\end{array}\right\} = C_2\left\{\begin{array}{l} C_2H_5 \\ CH_3 \\ \underline{OZnCH_3} \\ O \\ OC_2H_5H_5 \end{array}\right. + Zn''\left\{\begin{array}{l} C_2H \\ OC_2H_5 \end{array}\right. + 2ZnI_2$$

Oxalic ether. Zincmonethyl-ethomethoxalate of ethyl. Zincethylo-ethylate.



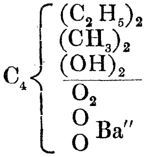
$$C_2\left\{\begin{array}{l} C_2H_5 \\ CH_3 \\ \underline{OZnCH_3} \\ O \\ OC_2H_5 \end{array}\right. + 2H_2O = C_2\left\{\begin{array}{l} C_2H_5 \\ CH_3 \\ \underline{OH} \\ O \\ OC_2H_5 \end{array}\right. + \left.\begin{array}{c}C_2H_5\\ H\end{array}\right\} + Zn''\left\{\begin{array}{l} OH \\ OH \end{array}\right.$$

Zincmonethyl-ethomethoxalate of ethyl. Ethylic ethomethoxalate. Zinc hydrate.

A not inconsiderable amount of the ether thus formed in this and in the analogous reactions described in our previous communications, appears to be decomposed by the zinc hydrate; at all events an appreciable quantity of the zinc-salt of the derived acid is always obtained from the residue left after distillation of the ethereal product.

Ethylic ethomethoxalate, as we propose to name the new ether, is a colourless, transparent, and mobile liquid, possessing a penetrating ethereal odour much resembling that of ethylic diethoxalate. It is very soluble in water, alcohol, and ether, and has a specific gravity of ·9768 at 13° C. It boils at 165°·5 C., and its vapour has a density of 4·98; the theoretical number for a two-volume vapour ($H_2O = 2$ vols.) of the above formula being 5·04.

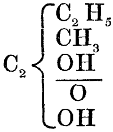
Ethylic ethomethoxalate is readily decomposed, even by aqueous solutions of the alkalies and of baryta, yielding alcohol and a salt of the base. The ethomethoxalate of barium was thus prepared. It crystallizes from an aqueous solution as a beautiful radiated mass of silky lustre, very easily soluble in water. Its analysis gave numbers closely corresponding with the formula



$$C_4\left\{\begin{array}{l} (C_2H_5)_2 \\ (CH_3)_2 \\ \underline{(OH)_2} \\ O_2 \\ \left.\begin{array}{l}O\\ O\end{array}\right. Ba'' \end{array}\right.$$

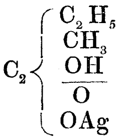
By exactly decomposing this salt with dilute sulphuric acid and evaporating the filtrate, first in a retort, and afterwards *in vacuo,* ethomethoxalic acid was obtained as a splendid white crystalline mass, fusing at 63° C., subliming readily at 100°, and condensing in magnificent star-like groups upon a cold surface. It boils with decomposition at 190° C. Ethomethoxalic acid is very readily soluble in ether, alcohol, and water; small fragments of it thrown upon water rotate like camphor whilst dissolving.

These solutions react powerfully acid, and readily decompose carbonates. The analysis of this acid gave numbers closely corresponding with the formula



$$C_2\left\{\begin{array}{l} C_2H_5\\ CH_3\\ OH\\ \hline O\\ OH\end{array}\right.$$

We have prepared silver ethomethoxalate by treating the free acid dissolved in water with carbonate of silver. This salt crystallizes in splendid mammillated masses half an inch in diameter, which are tolerably soluble in water. It gave numbers, on analysis, in accordance with the formula



$$C_2\left\{\begin{array}{l} C_2H_5\\ CH_3\\ OH\\ \hline O\\ OAg\end{array}\right.$$

February 23, 1865.

JOHN P. GASSIOT, Esq., Vice-President, in the Chair.

The following communications were read :—

I. "On New Cornish Minerals of the Brochantite Group." By Professor N. STORY MASKELYNE, M.A., Keeper of the Mineral Department, British Museum. Communicated by A. M. STORY MASKELYNE, M.A. Received February 13, 1865.

(Abstract.)

On a small fragment of Killas from Cornwall, I discovered, several months ago, a new mineral in the form of minute but well-formed crystals. The specimen had come from Mr. Talling, of Lostwithiel, a mineral-dealer, to whose activity and intelligence I am indebted for the materials that form the subject of this paper. After a little while he found the locality of the mineral, and sent me other and finer specimens; but these specimens proved to contain other new minerals besides the one already mentioned. Two of these minerals are described in this paper, and a third will form the subject of a further communication.

I. *Langite.*

The first of these minerals which I proceed to describe is one to which I have given the name of Langite, in honour of my friend Dr. Viktor von Lang, now of Gratz, and lately my colleague in the British Museum. It occurs in minute crystals, or as a crystalline crust on the Killas, of a fine blue with a greenish hue in certain lights. The crystals are prismatic. The forms observed are (1 0 0), (0 0 1), (1 1 0), and (2 0 1) & (0 1 0), the